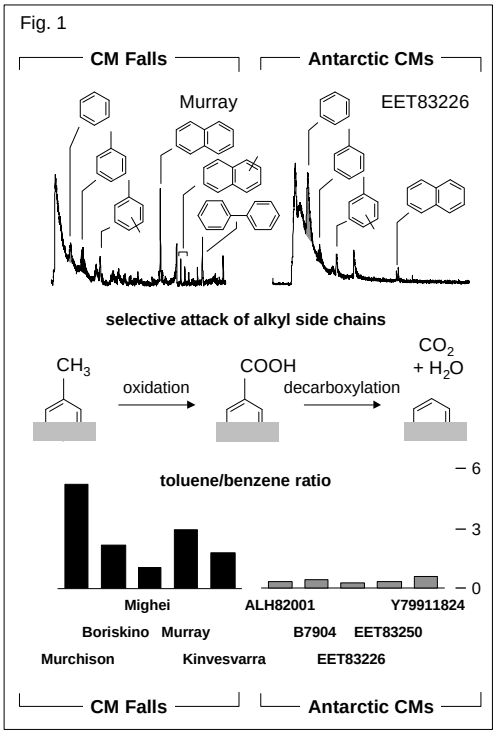
A "UNIQUE" DISTRIBUTION OF POLYCYCLIC AROMATIC HYDROCARBONS IN ALLAN HILLS 84001, OR A SELECTIVE ATTACK IN METEORITES FROM MARS? M. A. Sephton[1,2] and I. Gilmour[1], [1]Planetary Sciences Research Institute, The Open University, Milton Keynes MK7 6AA, UK (I.Gilmour@open.ac.uk), [2]MBT, NIOZ, PO Box 59, 1790 AB, Texel, Netherlands (sephton@nioz.nl).

Introduction: McKay et al. [1] detected polycyclic aromatic hydrocarbons (PAHs) in the Antarctic meteorite ALH84001 and claimed that they were distinct from those in terrestrial samples and carbonaceous chondrites (CCs) due to their lack of alkylation and low mass components. When considered with other results from this meteorite they concluded that the PAH were fossilized products of martian life. Subsequently Becker et al. [2] detected this "unique" distribution of PAH in another Antarctic martian meteorite (EETA79001), Antarctic CCs and the Antarctic ice itself. To investigate the causes of these PAH distributions we analysed the organic matter (OM) in 10 CM meteorites which represented both non-Antarctic falls and Antarctic finds.

Methods: Powdered unextracted meteorites were subjected to pyrolysis-gas chromatography-mass spectrometry (Py-GCMS) as in [3].

Fig. 1



Results: Comparing the Murray results from Fig. 1. and ref. [4] reveals that Py-GCMS and the L^{2}MS procedure used for ALH84001 give different responses for the same samples. Unlike L^{2}MS, Py-GCMS analyses the total OM present, i.e. small amounts of evaporated free compounds and larger amounts of degraded macromolecular material. Hence direct comparisons with ALH84001 are difficult. However, Fig. 1. reveals significant differences between the OM of Antarctic and non-Antarctic CCs. The released products from Antarctic CCs are less structurally diverse and benzene is significantly enhanced relative to toluene.

Discussion:

Antarctic PAH. OM in Antarctic meteorites appears substantially altered from its fall state. The effects of Antarctic weathering on meteoritic OM are poorly understood but the results of weathering on terrestrial OM are known [5]. One common feature is the preferential oxidation of aliphatic OM present as alkyl side chains. This process would explain the differences in toluene/benzene ratios from the non-Antarctic and Antarctic CMs (Fig. 1). Consequently, Antarctic PAH from any source may exhibit less alkylation than when unweathered. Therefore the unalkylated PAH distribution in ALH84001 appears more of a characteristic of the Antarctic environment than fossil Martian life. It is for this reason that similar distributions are found in other examples of Antarctic OM [2].

Implications. The effects of weathering on Antarctic meteoritic OM indicate that if its origins are to be investigated, methods must be applied to compensate for the loss of structural information by oxidation. ALH84001 contains 20 % indigenous C as an insoluble, possibly organic phase [6]. Therefore small-scale hydrous pyrolysis of this component followed by isotopic measurements of the products [7] would be appropriate.

Conclusions: During its time in Antarctica, meteoritic OM is weathered. Py-GCMS indicates that PAH alkyl side chains are selectively oxidized in free and macromolecular OM. Future interpretations based on PAH distributions in meteorites should take this process into account.

References: [1] McKay D. S. et al. (1996) *Science, 273*, 924. [2] Becker L. et al. (1997) *GCA, 61*, 475. [3] Sephton M. A. et al. (1994) *LPSC, 25*, 1247. [4] Kovalenko L. J. et al. (1992) *Anal. Chem., 64*, 682. [5] Martinez M. and Escobar M. (1995) *Org. Geochem., 23*, 253. [6] Jull A. J. T. et al. (1997) *Science, 279*, 366. [7] Sephton M. A. et al. *GCA, in press.*